Section 27 Cement Treated Bases

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Cement
Treated Bases

4-2701 General

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Cement-treated base (CTB) is composed of a mix of aggregate, portland cement, and water. CTB, specified as either Class A or Class B, is generally used only with asphalt pavements and can be either plant mixed or road mixed. However, plant mixed is most common.

CTB can be spread by three allowable methods. The special provisions will specify the class, mix method, and possibly the spreading method.

4-2702 Before Work Begins

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Before work begins, take the following steps:

- Hold a preproduction meeting with the contractor and the district materials unit to discuss the contractor's method of operations.
- From the special provisions or plans, determine the class of CTB required and the percent of cement to be added to the aggregate.
- For initial testing, obtain representative samples from the contractor's source of CTB aggregate, and test for the required quality. Compressive strengths of CTB can vary significantly because of variations in aggregate gradation and the type of cement used. The fine aggregate usually has the most variable effect on strength. Advise the contractor that any significant material change, including variations in gradation, must be covered by new tests for quality characteristics. Request strength tests at 5 percent of cement and other percentages above and below 5 percent (usually in 0.5 percent increments). For aggregates of borderline quality, consider making additional initial strength tests at varying gradations (within specifications), using 5 percent cement.
- For sources with reliable information on past performance, consider using such information in lieu of testing. However, a test should always be made at 5 percent for aggregate qualification.
- Based on test results, decide whether the percent of cement specified in the special provisions will produce the design strength in the finished product. When making the decision, consider that, because of production variables, a significant difference can exist between the strength indicated by a cylinder and the actual strength of the finished product. Allowable variations in cement content and compaction requirements are major contributors to differences between design and actual strength. If it is difficult to determine the effect of production variables on final strength, use the following guidelines:

  1. Increase cement content if the seven-day compressive strength of initial samples is less than approximately 6.9 Mpa.
  2. Decrease cement content if the seven-day compressive strength of initial samples at the percent specified is more than approximately 8.6 Mpa.

- Verify that safe and convenient facilities have been provided for sampling cement.
- In accord with the State Contract Act, verify that the material and aggregate source complies with the Surface Mining and Reclamation Act of 1975 (SMARA). Mining operations determined to be in compliance are listed on the AB 3098 SMARA Eligible List. You can obtain this list from the Division of Construction or the Department of Conservation's web site at http://www.consrv.ca.gov/omr/SMARA/3098-list. Also, see Section 7-103D to determine if the proposed materials site is exempt from SMARA.
- If the contractor will be batch mixing, examine the mixer before use and call to the contractor's attention any excessively worn or missing paddles.
- Before spreading any CTB materials, ensure that the subgrade complies with specifications and that the grade is free of loose or extraneous material. Record the findings in the daily report, including any instructions to the contractor.
- Determine that the asphaltic emulsion used for curing seal is the material specified, and obtain necessary certificates of compliance and samples.
- Decide on the application rate for the curing seal to be used, and advise the contractor accordingly. Base the determination on an amount that will provide a complete membrane without appreciable thickness. Ensure the application rate conforms to requirements.

4-2703 During the Course of Work

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During the work, do the following:

- Before mixing, obtain samples of the aggregate and test them for the specified attributes in accordance with the frequencies shown in Section 6-1, "Sample Types and Frequencies," of the *Construction Manual* (manual).
- To evaluate the compressive strength of Class A CTB, obtain samples during the first day of operation and approximately every fifth day of production thereafter. If these tests reasonably match the anticipated results based on the initial tests, you can reduce the frequency of the tests (unless a change in material is suspected or the material sources were changed).
- To determine compliance with permissible variations in cement content, obtain sufficient samples for California Test 338, "Determination of Cement or Lime Content in Treated Aggregate by the Titration Method." Section 6-1, "Sample Types and Frequencies," of this manual states the frequency should be "as necessary for control." This frequency may vary depending on the efficiency of the contractor's operation and rate of production. At a minimum, assign one inspector full time to run the titration tests while the operation is in full-time production. At the start of operations or when problems persist, more effort may be required.
- Determine whether compaction requirements are being met. It is Caltrans' policy to measure compaction separately for each lift whenever this separate measurement is physically possible.

4-2703A Road-Mixed CTB

For road-mixed CTB used during the course of work, do the following:

- If you think the quantity being placed obviously is not sufficient to complete the required structural section thickness, advise the contractor. Record any conversation in your daily report.

- Ensure the mixer introduces water by approved methods. To keep the resulting mixture uniformly moist, the mixer should be able to accurately vary the water rate. Advise the contractor to correct leaks or excessive water applications.
- Observe the mixing operation to ensure the uniform distribution of cement and water. When the mixer has a bottom shell or pan to pick up the material and separate it from the mixing table, ensure the shell or pan picks up all the material and doesn't cut into the subgrade.
- Ensure the cement is spread by mechanical equipment that can be calibrated to uniformly distribute the cement in the correct amount. Placing cement by hand methods, such as by sacks, is unacceptable.
- Take sufficient moisture tests to ensure the completed mixture's moisture content does not fall below one percentage point from optimum.
- For multilayer construction, ensure the contractor mixes and compacts each layer separately.

4-2703B Plant-Mixed CTB

For plant-mixed CTB used during the work, do the following:

- To calibrate and check the accuracy of weighing and metering devices, request assistance from the district weights and measures coordinator.
- Ensure the contractor is adding water by a method that permits the amount or rate to be verified. Obtain sufficient moisture tests to ensure the completed mixture's moisture content does not fall below one percentage point from optimum.
- To detect any obvious faults, observe the mixing operation and the mixture. Time the mixing operation to ensure it takes longer than 30 seconds. If observations or tests indicate poor cement distribution, require a longer mixing cycle.

4-2703C Depositing and Spreading CTB

During the depositing and spreading of CTB, do the following:

- Ensure the contractor uses the specified type of spreading operation.
- Generally, if loads are hauled in hot weather and if the haul takes more than 30 minutes, require covers on hauling units.
- Spreading can be a separate operation from depositing or it can be combined in a single operation with depositing. If spreading is a separate operation, ensure the contractor complies with the requirements for uniform placement.
- If you think the quantity being placed is insufficient to construct the required structural section thickness, advise the contractor. Record any conversation in the daily report.
- Immediately before placing CTB, ensure the underlying material is moist but not excessively wet.
- Observe whether significant segregation is occurring. If problems persist, perform additional tests to document the problem.
- Observe the surface condition of any lower layer of CTB. Ensure the contractor complies with moisture requirements for lower layers. Keep separate records for any curing seal placed on lower layers.

- Ensure the contractor uses satisfactory methods to place CTB in areas inaccessible to mechanical spreading equipment. The end product must be homogeneous, placed to the required thickness, and properly compacted.
- Ensure the contractor complies with temperature requirements for spreading CTB.

4-2703D Compacting CTB

During the compacting of CTB, do the following:

- Measure the operation's total time interval to ensure it conforms to Section 27-1.08, "Operation Time Requirements," of the *Standard Specifications*.
- To ensure compliance with compaction requirements, test each layer of multilayer construction.
- After the initial rolling, ensure the finished surface is within the specified tolerance. Require the contractor to trim high spots and to meet the requirements for filling low areas. Prohibit the contractor from filling low areas with loose material from the trimming operation.
- Ensure the equipment used for final compaction repairs any surface areas that the trimming has torn or segregated.
- To ensure compliance with the specified tolerance, measure the finished surface with a straightedge.

4-2704 Measurement and Payment

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For measurement and payment, do the following:

- Use contract change orders to cover ordered changes in the cement content.
- Do not pay as CTB any excess material used at other locations.
- When CTB is paid for by the tonne, refer to the discussion of weighing and metering procedures in Section 3-9, "Measurement and Payment," of this manual. Make any appropriate deductions for excess moisture.
- When CTB is to be paid for by the cubic meter, obtain quantity calculations from the project engineer to determine if they are sufficiently detailed and accurate to be used in the project records. Make appropriate deductions for any lack of compliance with thickness specifications.
- For more information about measuring curing seal, refer to Section 4-94, "Asphaltic Emulsions," of this manual.